

initially saturated with water at 80 °F (27 °C) and having 0.025 fluid ounces per gallon (0.20 milliliters per liter) of free water added and cooled to the most critical condition for icing likely to be encountered in operation. However, this requirement may be met by demonstrating the effectiveness of specified approved fuel anti-icing additives, or that the fuel system incorporates a fuel heater which maintains the fuel temperature at the fuel strainer or fuel inlet above 32 °F (0 °C) under the most critical conditions.

(5) The applicant must demonstrate that the filtering means has the capacity (with respect to engine operating limitations) to ensure that the engine will continue to operate within approved limits, with fuel contaminated to the maximum degree of particle size and density likely to be encountered in service. Operation under these conditions must be demonstrated for a period acceptable to the Administrator, beginning when indication of impending filter blockage is first given by either:

- (i) Existing engine instrumentation; or
- (ii) Additional means incorporated into the engine fuel system.

(6) Any strainer or filter bypass must be designed and constructed so that the release of collected contaminants is minimized by appropriate location of the bypass to ensure that collected contaminants are not in the bypass flow path.

(c) If provided as part of the engine, the applicant must show for each fluid injection (other than fuel) system and its controls that the flow of the injected fluid is adequately controlled.

[Amdt. 33–6, 39 FR 35466, Oct. 1, 1974, as amended by Amdt. 33–10, 49 FR 6851, Feb. 23, 1984; Amdt. 33–18, 61 FR 31328, June 19, 1996; Amdt. 33–25, 73 FR 48123, Aug. 18, 2008; Amdt. 33–26, 73 FR 48285, Aug. 19, 2008]

§ 33.68 Induction system icing.

Each engine, with all icing protection systems operating, must—

- (a) Operate throughout its flight power range (including idling) without the accumulation of ice on the engine components that adversely affects engine operation or that causes a serious loss of power or thrust in continuous

maximum and intermittent maximum icing conditions as defined in appendix C of Part 25 of this chapter; and

- (b) Idle for 30 minutes on the ground, with the available air bleed for icing protection at its critical condition, without adverse effect, in an atmosphere that is at a temperature between 15° and 30 °F (between –9° and –1 °C) and has a liquid water content not less than 0.3 grams per cubic meter in the form of drops having a mean effective diameter not less than 20 microns, followed by a momentary operation at takeoff power or thrust. During the 30 minutes of idle operation the engine may be run up periodically to a moderate power or thrust setting in a manner acceptable to the Administrator.

[Amdt. 33–6, 39 FR 35466, Oct. 1, 1974, as amended by Amdt. 33–10, 49 FR 6852, Feb. 23, 1984]

§ 33.69 Ignitions system.

Each engine must be equipped with an ignition system for starting the engine on the ground and in flight. An electric ignition system must have at least two igniters and two separate secondary electric circuits, except that only one igniter is required for fuel burning augmentation systems.

[Amdt. 33–6, 39 FR 35466, Oct. 1, 1974]

§ 33.70 Engine life-limited parts.

By a procedure approved by the FAA, operating limitations must be established which specify the maximum allowable number of flight cycles for each engine life-limited part. Engine life-limited parts are rotor and major static structural parts whose primary failure is likely to result in a hazardous engine effect. Typically, engine life-limited parts include, but are not limited to disks, spacers, hubs, shafts, high-pressure casings, and non-redundant mount components. For the purposes of this section, a hazardous engine effect is any of the conditions listed in § 33.75 of this part. The applicant will establish the integrity of each engine life-limited part by:

- (a) An engineering plan that contains the steps required to ensure each engine life-limited part is withdrawn from service at an approved life before hazardous engine effects can occur.

These steps include validated analysis, test, or service experience which ensures that the combination of loads, material properties, environmental influences and operating conditions, including the effects of other engine parts influencing these parameters, are sufficiently well known and predictable so that the operating limitations can be established and maintained for each engine life-limited part. Applicants must perform appropriate damage tolerance assessments to address the potential for failure from material, manufacturing, and service induced anomalies within the approved life of the part. Applicants must publish a list of the life-limited engine parts and the approved life for each part in the Airworthiness Limitations Section of the Instructions for Continued Airworthiness as required by § 33.4 of this part.

(b) A manufacturing plan that identifies the specific manufacturing constraints necessary to consistently produce each engine life-limited part with the attributes required by the engineering plan.

(c) A service management plan that defines in-service processes for maintenance and the limitations to repair for each engine life-limited part that will maintain attributes consistent with those required by the engineering plan. These processes and limitations will become part of the Instructions for Continued Airworthiness.

[Amdt. 33-22, 72 FR 50860, Sept. 4, 2007]

§ 33.71 Lubrication system.

(a) *General.* Each lubrication system must function properly in the flight attitudes and atmospheric conditions in which an aircraft is expected to operate.

(b) *Oil strainer or filter.* There must be an oil strainer or filter through which all of the engine oil flows. In addition:

(1) Each strainer or filter required by this paragraph that has a bypass must be constructed and installed so that oil will flow at the normal rate through the rest of the system with the strainer or filter element completely blocked.

(2) The type and degree of filtering necessary for protection of the engine oil system against foreign particles in the oil must be specified. The applicant must demonstrate that foreign par-

ticles passing through the specified filtering means do not impair engine oil system functioning.

(3) Each strainer or filter required by this paragraph must have the capacity (with respect to operating limitations established for the engine) to ensure that engine oil system functioning is not impaired with the oil contaminated to a degree (with respect to particle size and density) that is greater than that established for the engine in paragraph (b)(2) of this section.

(4) For each strainer or filter required by this paragraph, except the strainer or filter at the oil tank outlet, there must be means to indicate contamination before it reaches the capacity established in accordance with paragraph (b)(3) of this section.

(5) Any filter bypass must be designed and constructed so that the release of collected contaminants is minimized by appropriate location of the bypass to ensure that the collected contaminants are not in the bypass flow path.

(6) Each strainer or filter required by this paragraph that has no bypass, except the strainer or filter at an oil tank outlet or for a scavenge pump, must have provisions for connection with a warning means to warn the pilot of the occurrence of contamination of the screen before it reaches the capacity established in accordance with paragraph (b)(3) of this section.

(7) Each strainer or filter required by this paragraph must be accessible for draining and cleaning.

(c) *Oil tanks.* (1) Each oil tank must have an expansion space of not less than 10 percent of the tank capacity.

(2) It must be impossible to inadvertently fill the oil tank expansion space.

(3) Each recessed oil tank filler connection that can retain any appreciable quantity of oil must have provision for fitting a drain.

(4) Each oil tank cap must provide an oil-tight seal. For an applicant seeking eligibility for an engine to be installed on an airplane approved for ETOPS, the oil tank must be designed to prevent a hazardous loss of oil due to an incorrectly installed oil tank cap.

(5) Each oil tank filler must be marked with the word "oil."